DOCUMENT RESUME

ED 390 936 TM 024 561

AUTHOR Radnofsky, Mary L.
TITLE CHROMACODE: A Conceptual and Pedagogical Tool in Qualitative Data Analysis.
PUB DATE Apr 95
NOTE 19p.; Paper presented at the Annual Meeting of the American Educational Research Association (San Francisco, CA, April 18-22, 1995).
PUB TYPE Guides - Non-Classroom Use (055) -- Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Coding; *Color; *Comparative Analysis; *Data Analysis; *Qualitative Research; *Research Methodology; Visual Perception
IDENTIFIERS *CHROMACODE

ABSTRACT

CHROMACODE is a conceptual tool that uses systematic, logical, and visual processes for organizing and analyzing qualitative research findings for the researcher with relatively low technical knowledge of data analysis. It can best be described as a visual conceptual scheme with coding based on a color-dependent procedure. Color provides a sense of the variety of responses given in a category on a single theme. Collected and discussed data are transcribed onto colored paper, using a different color for each respondent and families of complementary colors for related groups. This provides a visual organizational scheme for further comparisons and coding in composite files in a computer. Such conceptual organizing facilitates broader analysis and reporting. (Contains 17 references.) (SLD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 390 936

U S DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it
Minor changes have been made to improve reproduction quality
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
MARY L. RADOFSKY
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

CHROMACODE: A Conceptual and Pedagogical Tool In Qualitative Data Analysis

Mary L. Radnofsky, Ph.D.
Adelphi University

BEST COPY AVAILABLE

Paper presented at the annual meeting
of the American Educational Research Association

San Francisco

April 1995

TM024561

CHROMACODE: A CONCEPTUAL AND PEDAGOGICAL TOOL IN QUALITATIVE DATA ANALYSIS

Mary L. Radnofsky, Ph.D.

Introduction

The purpose of this paper is to link theory regarding qualitative data analysis methods not only with actual fieldwork, but also with the practice of teaching such theory and its tools to beginning researchers. CHROMACODE serves the qualitative researcher's needs for both micro and macro analyses of complex data, and acts as a pedagogical tool for the professor of qualitative research methodology and analysis.

CHROMACODE is a conceptual tool that uses systematic, logical, and visual processes for organizing and analyzing qualitative research findings for the "lo-tech" or "no-tech" qualitative researcher. Although its basic principles may lend themselves to computer application, one essential tool needed for qualitative data analysis is lacking in current technology: the ability to show all the relevant data simultaneously --- a serious, and at present, compromising flaw, because:

> Simultaneous visual access to material is what makes the ideas happen (Agar, 1991, p. 193).

CHROMACODE is therefore premised on the most extensive use of visual information available on a given set of qualitative data, and may thus not necessarily be adaptable to computerization, since computer screen capacity is currently relatively limited. However, in initial stages of organizational handling of data, some computer programs may indeed be useful.

Related Research

Most researchers transcribe, write analyses, compose and create using word processing and draw programs; in general, technology today has become an invaluable tool for an ethnographer who needs to insert and correct, annotate, shift text, etc., and who has little office space in which to store massive amounts of documents and artifacts collected in various studies. I would, therefore, ally myself wholeheartedly with both Seidel (1991) and Agar (1991) in recognizing the potential benefits of computer technology in qualitative research --- but "I have also become convinced that it has a dark side" (Seidel, 1991, p. 107).

Seidel (1991) outlined this dark side in three fundamental concerns about the threat of computer programs that foster "analytic madness": first, a worry that depth or "resolution" would be sacrificed for "scope" due to increased volume of data; second,

that there would be a distancing of the researcher from data; and third, that there would be "reification of the relationship between the researcher and the data" (p. 107), the danger being that we would "base our understandings of the phenomena on these reified objects, and in the process, lose the phenomena" (p. 114).

It is, in fact, this loss of integrity of original data which seems to most threaten its artful interpretation and analysis. Richards & Richards (1994) write that word processors risk "distorting rich records, diluting 'thick description,' or demanding routines that destroy insight" (p. 446). Furthermore, they have maintained that computer technology has eliminated the "untypable" (Richards & Richards, 1989), described by Fielding & Lee (1991) as "the fleeting notes, doodles, and marginalia within which insight is often captured" (p. 8).

Indeed, there is much lost in the transcription process, especially when transcribing video and not merely audio tapes. "The analysis of text derived from a video record runs the risk of disregarding the complex interrelatedness of words and actions, expression and activity" (Knapp and Harrison, 1972, cited in Hecht, et al, 1994, p. 5). Transcriptions, should, nevertheless, be part of the data to be analyzed from videotape, but should not act as a replacement. An "image/text balance" (Harper, 1994, p. 404) needs to be struck that will "contribute to our ability to develop a deeper understanding" (Radnofsky, 1995, p. 1) of the data being analyzed, just as both image and text, or models and the spoken word, may be used in making meaning of emergent theory.

The importance of analyzing transcriptions --- as secondary sources --- comes in understanding that they are indeed secondary, and not original sources. Thus, some compensation needs to be made for all the non-verbal data that are lost. Unfortunately, this does not usually happen; in fact, as transcriptions pass to computer analysis programs, even more is lost of the original content and context of this discourse.

The temptation to simply transfer everything into an electronic medium to facilitate analysis is admittedly tremendous, but has many drawbacks. Notably, a researcher may fall into overdependence upon a machine to do one's work, or into a sort of unintended behavioral bliss, failing to see the inappropriateness of the computer's programming to analyze a given data set because of routinized behavior of coding and categorizing. To this threat, Richards & Richards (1994) lengthily warn of "the real dangers of software constraining and distorting research" (1994, p. 445):

> Computers offer no instant solutions to the problems faced by qualitative researchers, because the data they handle are particularly resistant to tidy processing methods and the methods they use are very unlike the techniques computers easily support (p. 445).

In essence, removing the researcher from the data "by getting a machine to insert new codes when it finds others, without care to see if the insertion of the new code is justified by the text" (Richards & Richards, 1994, p. 456), risks distorting theory that ought to be emerging from the data, not from methods.

Despite these criticisms (often from software program designers themselves), a multitude of computer programs have flourished in the past several years. The need for and the value of efficient organizational and retrieval systems is well-established in most research libraries nowadays, and so researchers have sought to apply this new technology to all aspects of our work. Granted, the computer's potential for organization and management of data is enormous, but its potential for giving "the right answer to the wrong question" (Agar, 1991, p. 181) is equally as grand. This seems especially true when new qualitative data analysis programs are used by novice researchers:

> ... who may find their own rich and messy records to be alarming in their diversity, [and] may be further alarmed by software that seems to celebrate diversity... Novices, too, are often stalled by anxiety about creating a perfect index system up front... (Richards, & Richards, 1994, p. 458).

Four years ago, Fielding & Lee (1991) reviewed twelve extant qualitative data computer analysis programs, and gathered experts' opinions and predictions regarding the value of computer-aided analyses for those who were just venturing into the electronic world. Today, twenty-four computer programs have been chosen out of the dozens that now exist, and thoroughly reviewed by Weitzman & Miles (1995) in Consumer Digest-fashion, but in what amounts to a foreign language, forcing the authors to admit that, "if you have had no experience at all with qualitative work, the book will be very hard to make sense of" (p. 4). It stands nevertheless as a sign that such programs are valued tools in our field, and that they cannot be ignored.

It should be made clear at this point, that there is absolutely no attempt here to specifically condemn any of the computer programs reviewed, nor to criticize researchers for using them; on the contrary, they can, in fact, be time-saving tools for *limited*, specific purposes. Who would ever return to manually, type-written transcriptions, carbon paper copies, or, heaven forbid, no copies at all?

However, for the novice researcher, these computer data analysis programs and others like them, have the flaw of providing a service which potentially allows one to avoid *having* to, or even electronically *being able* to look *simultaneously* at his or her findings from multiple sources, thus hampering the possibility of

gaining the invaluable, wholistic perspective on the data. A wholistic view is one which "emphasizes the functional relation between parts and wholes" (Webster, 1977, p. 546), and is clearly necessary when trying to develop a theory that will "capture a great deal of the variation that characterizes the central phenomena studied" (Strauss, 1987).

Experienced researchers know that it is imperative to look at the parts of a study not merely re-assembled into new wholes, but to look at the parts in relation to the ensemble of collected data in order to construct solid, grounded theory. Quite simply, because of limited screen space, this cannot be done on a personal computer.

It must rather be done with hard copies spread out of transcriptions, written & drawn notes, photos, artifacts, drawings, slides, and tapes. Agar (1991) considers an alternative to this, though, musing that if he could "sit in the middle of a room-sized screen," (p. 192), then he would have all those computer-saved data at his disposal in a similar way as I would with hard copies. However, to my knowledge, a "wrap-around computer screen" the size of a room only exists in our minds as we attempt to simultaneously visualize all the relevant data for a given analysis. A computer cannot "do" this for us.

Computer analysis programs do, however, perform invisible tasks that reassemble coded parts of data from several sources; with the computer, a researcher can do this without having to look at the contexts of those texts, and without having to look at surrounding data. Thus if a paragraph has been unintentionally omitted, if there is a typo, or if a preliminary code has not been replaced by an updated one, there is virtually no way that the researcher can know that the computer has missed it, since he or she is no longer dealing with the whole body of data in the context of the original sources.

Furthermore, and although it sounds obvious, while the computer program assembles or searches for text or codes, the researcher is *not* searching; interviews and arguments are not being re-lived; songs and dances are not being re-performed; the life, the ambiance of the setting and the phenomena have been flattened and risk being forgotten to all but a mindless computer which can but mechanically search for key words and organize, organize, organize.

The act of coding, recoding, and repeatedly revising codes until a core category evolves, forces the researcher, while engulfed in the data, to see patterns within it. If we stop interacting so intensely with the data, we stop seeing the relevant patterns that lead to theory development.

In qualitative data analysis, it is the intangible, repeated, personal experience with data that contributes to the researcher's understanding of phenomena. Agar (1991) remarks on such a "critical way of seeing" which comes from "little bits of data, massive amounts c thinking, and slippery things like intuition and serendipity" (p. 193). Richards & Richards (1994) add that "Misuses [of computers] could contradict the central goals of building up understanding from data by forever returning to it" (p. 456).

Furthermore, familiarity with findings and with research participants in their social interactions fades with disuse of raw data. Being given an easier way to find a theory to explain those phenomena can mean not having to think about why one is doing it. Thus procedures, and facilitation of them become the focus of work, not understanding why one is proceeding the way one does, or how one is coming to certain conclusions. The defense of the discovered theory risks being: the computer found the most instances of a code in the data, and therefore it must be the core category.

Although these mistakes may also plague the lo-tech researcher analyzing typed or handwritten data, the risk is greater when the whole can no longer be seen, and when neat, clean chunks of text are produced almost instantaneously, and without thought, by a computer. So before becoming dependent upon a computer program to help analyze qualitative data, it would be wise to consider Weitzman & Miles' (1995) opening statements in their new software sourcebook:

> "There is no computer program that will 'analyze' your data... Computers don't analyze data; people do" (p.3).

The Development of CHROMACODE

CHROMACODE has developed, now in Phase II, into what can best be described as a "visual conceptual scheme" --- in other words, a set of interconnected, thinking processes that have been made visible. As such, it establishes a plan of action that can be followed, and is adaptable to an individual researcher's needs, from initial coding practices to theory generation and reporting.

The coding of CHROMACODE is based upon a color-dependent procedure. As a non-linguistic communicative device, color may be used to signify meaning at an automatic response level. As the brain overloads with words --- hundreds of thousands of them --- the eye remembers shapes, colors, signs, and symbols, etc. that stand for other meanings.

For example, an octagonal red sign at an intersection in this country signals to (most of) us to slow down and stop --- *whether or not we can actually read or see the word "stop."* Likewise, in the world of traffic, the light at the top of a triplet of

red/yellow/green lights is always red, and it too sends us the message to stop, just as green means to go, etc.

In the world of marketing, colors and shapes on generic and imitations of brand-name products are matched almost perfectly to indicate to the prospective buyer that this product is identical to the original product. Market experts tell us: "En matière de reconnaissance, ce qu'on reconnait en premier, c'est la couleur, ensuite la forme globale, après il y les images, et enfin les mots [Regarding matters of recognition, what one first recognizes is color, next overall form, then pictures, and finally words]" (Kapferer, 1995).

Colors are also used in maritime flags for sending messages: colors represent letters and phonemes, and, when strung together, take on original meaning for communication. Colors have also been used to represent the names of piano keys (e.g., do, re mi, fa,sol) in order to teach small children how to "read" music, by matching the color of the piano keys to those arranged on the page.

So, whether as an alternative for words, as a tool for establishing automatic responses, as a marketing device, or as a simple designation, color serves a vital function in our symbolic thought processes.

The messages which we potentially associate with different colors can advance our own work in qualitative data analysis procedures, too, by taking a respondent who has been reduced to mere transcribed words without the rich context painstakingly gathered by doing qualitative research, and rendering him or her "three-dimensional" again. Color can become the trigger symbol representing to our memory, the lost environmental messages we originally perceived in the field setting, but that were captured only in auditory (or at best, visual and auditory) form as messages on tape.

Thus color may be useful not only for permitting the researcher to immediately identify different speakers in a study, but, for example, for associating some mood or setting in which they were interviewed. "Capturing" moments for the purpose of fully analyzing them, (e.g. Glesne & Peshkin, 1992), and not merely for the purpose of making a "Kodak moment," is essential in gaining insight into the complexity of the research setting; the use of color as a sign contributes to recapturing those moments.

Thus, CHROMACODE aids the researcher not only in managing mounds of data through its organizational and cross-referencing scheme, but in developing a new perspective on one's data; colors may be carefully chosen to represent individuals, families, groups, gangs, etc. and give immediate information to the researcher as to their identity, so that he or she may delve into a different layer of understanding to focus less on data handling, and more on

meaning. Such meaning can be found not only in the *words* spoken by the participants, but in their very presence in a designated category of the study. Furthermore, through accompanying, color-coded, descriptive field notes, the researcher may also study non-linguistic areas of the participants' interactions, for example, their relationship to each other, and their place within the study.

Color is known to spark the memory, the imagination and the mind in ways that words do not, and cannot; in fact, Gardner (1983) and Armstrong (1994) indicate that of our seven intelligences, (linguistic, logical/mathematical, spatial, interpersonal, intrapersonal, musical, and bodily-kinesthetic), we over-rely on that of linguistic in our academic responsibilities as teachers and students, to the detriment of other intelligences.

However, to ignore our ability to make sense of complex data in alternative ways is to do a disservice not only to ourselves, but to the possibilities offered by the data we are studying. When we see words, we code, identify patterns, and search for some truth to explain what we have seen and heard, almost always with more words. Yet in CHROMACODE, it is color that provides the immediate, visual impression and sense of the variety of responses given in a category on a single theme, and allows the researcher to know exactly who is speaking, and to what group he or she naturally belongs. A tremendous amount of information is carried in a totally non-linguistic sign: color.

For example, divisions of color may be made into warm and cold, and divisions of humanity may be made into male and female. Further decisions as to which colors to assign participants could be based on age: colors exist along a wide spectrum of shades, just as age can go from the very young to the very old. Thus, a young woman might be represented by a light yellow, or an old male by a dark blue. Certainly other natural associations can also be represented, and should be chosen by individual researchers.

The homo- or heterogeneity of colors and shades under a given theme or category thus allows an unmediated impression, and therefore immediate access to meaning, so that the researcher may begin thinking about the significance of *whose* words are being studied, to *which* group they belong, and *what* the words may mean. In so doing, the task is artfully facilitated of taking flat, linguistically-bound discourse and transforming it back into the three-dimensional, living participants for proper analysis within the research context.

Color, then serves as an alternative "symbol system" that may represent the people and phenomena being studied. However, Eisner (1991) explains that, "Because any symbol system both reveals and conceals, its use provides, of necessity, a partial view of the reality it is intended to describe or depict" (p. 46). Therefore,

neither linguistic symbol systems nor a color-based symbol system may thoroughly "re-present" a given situation. Logically, then, a deeper and more thorough representation could be gained by complementing a linguistic with a color symbol system, such as in the creation of color-coded models that accompany color-coded text (Radnofsky, 1995). However, the color-coding of text is already an important step in contributing to a deeper understanding of the phenomena under study, and can be easily taught to students of qualitative study and data analysis.

CHROMACODE as a Pedagogical Tool

Conceptual/pedagogical pieces like CHROMACODE are starting to make the link between research and practice by addressing the pedagogical need to understand the thought processes behind qualitative data analysis methods. This kind of work gives young researchers a new way of looking at and analyzing the cultures they study, often those of complex classroom and school environments that require considerable organizing before sense can be made of the data they yield.

A beginning researcher needs to look at all the data, all the possibilities, and go through all the steps of data collection, organization, analysis, and interpretation. To the untrained eye of a novice researcher or to the unfamiliar eye of the overworked expert researcher, invisible computer-generated procedures that do much of this work may easily be misused, underused, overused, and confused.

Conversely, manipulation of findings, notes, and artifacts must still be done "by hand" in a scheme such as CHROMACODE, and it is precisely these visible procedures that represent its most valuable attribute as a pedagogical device. The program may thus serve expert researchers who must teach, in a 30-hour course, the theoretical and practical differences between qualitative and quantitative research. For those of us who guide graduate student researchers in the principles of qualitative research design, it is important to illustrate the rigorous procedures necessary to analyze transcribed and other non-statistical data. Among our students, though, there are still hundreds who are virtually computer illiterate.

It is quite evident that some link needs to be made between the numerous textbook descriptions of qualitative research methodology, and the sophisticated technology providing us with increasingly popular computerized data analysis programs. CHROMACODE is prepared to do just that. A description of its basic principles and procedures follows.

BEST COPY AVAILABLE

Principles of CHROMACODE

In a traditional library card catalog, users look in a Subject catalog under general categories that interest them; they are then referred to "see also" cards leading to other sources. However, many libraries are now equipped with computer databases that permit users to type in "keywords" so that books and articles are retrievable by a large number of such cross-referenced words.

The important characteristic of both the traditional and more modern systems of library information retrieval is that they depend upon a cross-referencing scheme that allows a person to find all available documents in a given category. This is possible either by flipping manually through cards, or by employing Boolean logic in a computer search, expanding with "and" or limiting with "or" in the search for just the right book or article.

For the purposes of qualitative data analysis, a similar cross-referencing system is required, because data in the form of interview transcriptions, may have to do with "school matters," for example, but may simultaneously touch upon three, four, or five other topics of interest to the researcher. Instead of photocopying the conversation as many times, each category can simply carry a cross-referenced mention of the location of the original source.

However, the qualitative data cross-referencing system is not as simple as that. It must also account for identification (using pseudonyms) of the speaker[s], the general group to which they belong, their grade level, tenure, seniority status, race, gender, family connection, etc.

Thus the system to identify and cross-reference data must take on another dimension, and with CHROMACODE's color-coding aspect, this is possible. Furthermore, for the low-tech or traditional researcher, the process is equally as effective as for the more computer literate user.

This paper addresses mostly a traditional approach, but with the use of a word-processing or extant analysis programs optional (they have their own search capabilities that are useful in retrieving quotes and other details). Ideally, though, some computer program, (that is yet to be designed) would permit the researcher to simultaneously open *and* simultaneously view multiple files, documents, or scanned images using different background screen colors, to receive greater amounts and kinds of data than can be received under current technology. Until that time comes, however, schemes which make accessible simultaneous information are vitally needed to "make the ideas happen."

Review of Data Collection Activities That Precede Analysis

Techniques

We collect data by one or more of the strategies used in qualitative research: e.g. observation, listening, individual interviews, focus groups, street ethnographies, psychological strategies, life histories, historical research, kinesics, proxemics, document analysis, and unobtrusive measures, all using some sort of drawn, written, audio, visual, and/or audio-visual recording techniques. Such data collection proceeds until saturation occurs with numerous examples of behavior or descriptions, leading to different avenues of inquiry. These data will likely have been transcribed and exist on both hard (paper) copies and soft (disk) copies, with backups stored for safekeeping.

Debriefing

During and after data collection, researchers discuss findings with a "debriefer," a trusted colleague not part of the setting, able to identify weaknesses in methodology, new paths to pursue, theories to consider, and questions to be asked in return interviews or observations. Notes from these debriefing sessions are made, or transcriptions done and included in Field Notes.

Field Notes

Throughout data collection, extensive Field Notes document observations; they provide the deep background, the "thick description" of the setting that will later contribute to the credibility of the research. Field Notes probably cover most of the following: **Methodological Notes** which describe procedures to collect or analyze data; **Personal Notes** which trace personal feelings, attitudes, health; **Research Notes** which lead to related research; **Interview Notes** which may be taken during or shortly after actual interchanges; and **Theoretical Notes** which reflect thoughts and tentative theory development to explain the phenomena. **Debriefing Notes** may fall in any of the above-mentioned categories, or which may constitute a single category.

Data Handling Using CHROMACODE

Transcriptions

Though not necessary to personally transcribe recordings, it is advisable that the primary researcher read through the transcriptions while listening to the tapes several times, not only to ensure accuracy, but to refamiliarize him- or herself with the ambient noise, the mood of the interview or observation, the interruptions, laughter, pauses, and other relevant non-linguistic information. When appropriate, these should be reported within the transcription, for they serve not only as reminders of the setting,

but to bring the respondents alive, making them "three-dimensional" again, even though only their words remain.

Transcriptions should first be printed, single-spaced, on regular white paper, and these hard copies stored in a safe place, separate from one back-up soft copy. Another soft copy should be on hard disk to facilitate later searches.

Now, the practical foundation for using CHROMACODE is built: Transcriptions should be printed on colored paper --- a *different* color for *each* respondent. For respondents who belong to major group, families of complementary colors should be used, as mentioned earlier. Different possibilities include: pastels for one group and bright colors for another; shades of yellows, reds, blues, greens for different gangs, etc., or light colors for younger people and dark, saturated colors for older ones. Since CHROMACODE is a conceptual tool and not a pre-determined set of guidelines, the researcher may choose whatever colors make the most sense for the data and the respondents. (For color-blind researchers, fully saturated colors can sometimes still be distinguished; alternatively, patterned and/or textured papers will serve the same purpose here.)

This first step in using CHROMACODE acts as a visual organizational scheme to immediately identify respondents (especially if they have been assigned pseudonyms which have not yet taken on meaning for you, the researcher), so that you may later code and analyze interviews, observations, etc. into thematic categories according to your preferred style of coding. Again, although a coding system is recommended, none is imposed, and researchers may use their own symbols, signs, codewords, categories, etc. on the color-coded transcriptions.

Excessive word-based coding and categorization processes are simplified when you no longer have to consciously keep respondents separate by name, group affiliation, etc.; having been freed of this through color-coding, the researcher may then reflect more deeply on the significance of what categories are emerging from the respondents' words, described actions, or Field Notes.

If you plan to code debriefing sessions or Field Notes, you may wish to use different colored papers for each type of note as well. The color of the Notes should be distinct, since later, it will be important to know the source and nature of the information being cited as supporting the emergent theory; original quotes from respondents carry a different meaning than a researcher's interpretations, and these should easily be distinguishable.

The largest ethnography I conducted had 38 different individuals who had been interviewed or who had participated actively in the setting, and I was able to find colored paper for

all of them, and for my notes. (If you have trouble finding enough different colors, though, try several office supply warehouses, arts and crafts stores, and printing services for different dye lots, quality, grain, thicknesses, and patterns of paper).

Initial Coding

As you read through the interviews on the colored papers, some categories of behavior, events, groups, or phenomena will emerge, as in any qualitative study. You will code these phenomena using the first classification terms that make sense to you, the researcher. These serve as your initial codes, that is, those that are often in the language of the respondents themselves (e.g. "field trips," "in-services," "paras [paraprofessionals]," aides"). At this point, you should bracket (]) the part of the transcription to which you are referring. Important: If more than one code seems to apply, it must be marked, bracketing the appropriate sections of the text for each codeword given. This is the slow and tedious part of any analysis, but there is no computer program that can make it any easier; the researcher must eventually read through entire texts and code them appropriately.

As codes are marked in the text, they should also be noted in a separate file on the computer, or on a notepad, if working by hand. This list will, at first, be established in no particular order, much as lists during a brainstorming session are generated. The difference is, of course, that these themes emerge directly from the data, in accordance with the principles of inductive theory development. Noting categories in a separate file or on a notepad will help later in collapsing and separating them as needed, and in identifying the Core Category, the one which best describes the main theme[s] indicated in the data.

Existing guidelines which govern the setting offer a good starting point for early codes, if you are new to the process. Be careful, though, not enter into coding with preconceived categories which may blind you to more appropriate ones.

Constant Comparisons

Throughout data handling, (and for that matter data gathering, for the two are often simultaneous), you may have been making "constant comparisons" of groups, concepts, and observations (Glaser & Strauss, 1967; Denzin & Lincoln, 1994), comparing newly-coded events with previously categorized ones, to see if new characteristics or properties emerge that differentiate them sufficiently to justify creating another category to more effectively describe them. To collapse or separate categories in any word processing program, click and drag, or block and cut them in various combinations; on paper, use colored pens, arrows, circling, or whatever technique you prefer to consolidate them.

As you compare one category with another, you also begin to develop tentative theories which begin to explain respondents' behavior, their perspectives based on events, and how they interact. At this point, you will still be working primarily with words, (since number coding too early on in data analysis is both a hindrance because one must keep referring to a chart of what the numbers mean, and a constraint: the category number may change, even disappear, but the word representing the concept will only transform into a better word or a larger or smaller category, etc.). Your work, then, involves not only understanding the behavior and thought processes of the respondents, but your own as well, especially if you have been closely participating in the life of the setting being studied.

Category Identification

Once the initial codes are made on the colored transcriptions, and collapsed into categories that more appropriately describe the activity or attitudes expressed by the respondents, categories of more universal importance develop. At this point, it is useful to number as well as name the categories, since cross-indexing will be quicker using numbers than words.

For example, the official organizational arrangement of people in a school may be far less relevant to the respondents than is their relationship to an unofficial "they" group of colleagues who are perceived to be those in the powerful positions. Understanding who is "us" and "them" adds richness to the ethnography, as the researcher learns about a complex web of relationships that shifts each time a new group forms.

In a recent interview study conducted of a district's supervision, staff development, and evaluation program (Radnofsky & Spielmann, 1995), both teachers and administrators became "them" to a large cohort of teachers who saw the new supervision program as an annoyance created from above. While these teachers seemingly did not fit under any other umbrella as a group (they were not, for example, all good teachers or bad teachers, male or female, white or minority, tenured or untenured), the one common thread was that they saw the central committee as a "them." These teachers' reactions could then be identified and better understood in the context of the new reform program and new alliances in it.

The more-or-less definitive big categories should be numbered both on the master list and on the colored transcriptions; the names of the categories will still appear, next to the numbers, to completely identify the category or theme. If these are done on computer, they should be stored in separate folders; if done low-tech, large envelopes should be clearly marked with both numbers and names of categories. (Depending on the quantity of transcriptions, several large envelopes for major categories will be needed: 1000-2000 pages will require a dozen or so 10x14

envelopes, and will contain the cross-indexed themes discovered through coding and categorizing above.

For computers, one or two 2Mb floppy disks should suffice. Remember that chronological transcriptions exist both in hard and soft copies, so that to recreate a context, you can easily do so with any word processing "search" feature. If you have typed or handwritten data, page numbers will help, but the entire procedure will inevitably be slower under such conditions. It would be wise to investigate the possibility of scanning such documents into a computer program so that they are reproducible and manipulable.

Cross-Indexing and Sorting Thematic Categories

With the number- coded and categorized transcriptions and Field Notes on their colored papers, the old-fashioned, and easiest cross-indexing scheme is to take scissors in hand and begin cutting between different bracketed themes. It now becomes important to note where more than one code has been placed, and to what new category it may apply, because the library cross-indexing referred to earlier is now put into place.

Procedurally, it is quite simple: write the cross-index note on a small strip of colored paper --- taken from the *same* color as the respondent on whose transcription you are working (usually from the bottom of every page, as most printers leave generous margins). The cross-index phrase will identify the category by its number code (for example: "5e" for Teacher-satisfaction) *and* the reference for the location where the actual transcription sits (for example "5e see 4d." The original discussion with both "4d" and "5e" codes is located in envelope #4. The researcher thus knows that there is part of a text for teacher Green, for example, in envelope #4 on Student Matters (4d) that also refers to Teacher Satisfaction (5e).

Lowercase letters attached to number codes often refer to the first codes used on the transcriptions, but if the data generate few categories or changes from the original, they may not be necessary. The key is to use just enough information for you, the researcher, to correctly identify the theme, but not so much as to get bogged down in too many words. The coding procedure may be time-consuming, especially at first, but it is more than a mere mechanical process; it is a creative, problem-solving challenge to make sense of a complex setting and relationships within it.

When it comes time to gather all the relevant transcriptions and Notes on a given theme, you will be able to find them quickly in the envelopes or, using a computer, on the new data file for that category. These (computer) composite files may get quite large, especially for the Core Category, and I would suggest a separate floppy disk for each, or an expanded memory for a modest hard drive. The large file that you create for each major category,

combining all the related comments to a given theme, will usually not be useful to print out as a document, as its main use will be for searching, blocking and shifting texts to a final report, or for precision searching by keyword to find out who said what on a certain subtopic of the category.

Theory Discovery - Induction and Deduction

The development of grounded theory being the goal of this research, CHROMACODE allows you, the researcher to move easily among the following three stages as an on-going activity, alternatively using: 1) Induction, which leads to the discovery of a tentative theory or hypothesis; 2) Deduction, which forces you to draw conclusions from your hypothesis and leads you to reexamine data in an attempt at 3) Verification, checking out your early hunches against observed events and with your participants, to see if the developing grounded theory is indeed descriptive of the data you collected (Strauss, 1987).

The data organized with CHROMACODE may be examined in any of the following ways: a) by respondent in linear form from original transcriptions or recordings; b) by theme in each separate envelope or composite file, and by respondent for each theme, thanks to the color-coding; c) by original code within each category in the envelopes or composite file, and by respondent for each code; d) by themes discussed in tandem from a single respondent, thanks to the multiple coding and cross-indexing of bracketed text; and e) by frequency of reference to the core category, identified by numerous, lengthy entries and consistent cross-references to it. Analyses then proceed in a manner consistent with the researcher's own philosophical framework until a satisfactory theory has been articulated.

Reporting

Qualitative research is usually reported in the form of case studies or stories. These narratives provide a rich picture of the setting and the events that led to the discovery of the theory. Since analyses of given anecdotes, quotes, and incidents should be amply provided, in order to give the reader a sense of having "been there," evidence of the emergent theory is required. CHROMACODE's conceptual organization facilitates location of relevant texts and contexts to support theory; most computer programs' search and retrieve features are useful, and appropriate at this stage of traditional reporting activities.

Directions for Future Developments with CHROMACODE

As alternative, non-print reporting methods are being explored in qualitative research, including narrated video presentations building upon documentary-style films, and multimedia or hypertext (non-linear) computer programs which lead the reader in the

direction which most applies for him or her, it becomes evident that flexible analytical schemes will be required in order to accommodate the organization and storage of raw data as well as interpretations which may be used in their original form. (Such technological reporting can only be done, of course, if all involved participants agree to give up their right to confidentiality and anonymity; procedures for protecting the identity of those who wish to make their opinions known, but do not want to be identified can be arranged by using voices only.)

If alternative reporting methods are pursued, the efficient retrieval of both audio and video sequences, as well as artifact and document location, will be needed for editing purposes. Some computer programs mentioned earlier are beginning to code original tapes so that they will be retrievable more easily than current fast-forward and rewind searching methods. However, they are not yet in common use, and the digitalizing equipment needed is still rather expensive.

However, I foresee continued experimentation in the use of these diverse presentation styles, as they seem to be perfectly adapted to the nature of qualitative research reporting. Indeed, early anthropological and ethnographic studies complemented by photographs and film showed the power of the visual media; advanced technologies can now extend that power to allow us to create innovative models to better illustrate our understanding of diverse cultures and settings.

Furthermore, by expanding the use of conceptual organization schemes such as CHROMACODE with multimedia sources, researchers will be better able to deal with complex categorization, coding, analysis, storage, and retrieval of data in virtually any form. Consequently, an entirely new format for disseminating scholarly research may evolve: *The Hypertext Academic Article* --- available, of course, on the Information Superhighway.

REFERENCES

Agar, M. (1991). The right brain strikes back. In N.G. Fielding & R. M. Lee (Eds.), Using computers in qualitative research (pp. 181-194) Newbury Park, CA: Sage.

Armstrong, T. (1994) Multiple intelligences in the classroom. Alexandria, VA: Association for Supervision and Curriculum Development.

Eisner, E. (1991). The Enlightened eye. New York: Macmillan.

Fielding, N. & Lee, R., (Eds.), (1991). Using computers in qualitative research. Newbury Park, CA: Sage.

Gardner, H. (1983). Frames of mind: The theory of multiple intelligences. New York: Basic Books.

Glesne, C. & Peshkin, A. (1992). Becoming qualitative researchers. White Plains, NY: Longman.

Hecht, J., Roberts, N., Dwyer, D., & School, P. (1994). VTLOGANL: A computer program for coding and analyzing data gathered on video tape. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Kapferer, J-P. (commentator). (1995). Emission de France 2 ADARC [television presentation]. Francevision. Airdate: March 4, 1995.

Knapp, M. & Harrison, R. (1972). Observing and recording the nonverbal data in human transaction. Paper presented at the annual meeting of the Speech Communication Association, Chicago, IL. (ERIC Document Reproduction Service No. ED 074 528)

Radnofsky, M. (1995). Designing Models to Represent Complex Data on Restructured Schools. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Radnofsky, M. and Spielmann, G. (1995). Shared Decision-Making & the Limits of Democratization: A Case Study of Site-Based Reform. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Richards, L. & Richards, T. (1989). The impact of computer techniques for qualitative analysis, Technical Report, no. 6/89, Department of Computer Science, La Trobe University.

Richards, T. & Richards, L. (1994). Using computers in qualitative research. In N. Denzin & Y. Lincoln (Eds.), Handbook of Qualitative Research. Thousand Oaks, CA: Sage.

Seidel, J. (1994). Method and madness in the application of computer technology to qualitative data analysis. In N. Fielding, N. & R. Lee, (Eds.), Using computers in qualitative research (pp. 107-116). Newbury Park, CA: Sage.

Strauss, A. (1987). Qualitative analysis for social scientists. New York; Cambridge University Press.

Webster's New Collegiate Dictionary (1977). Springfield, MA: G. & C. Meriam Co.

Weitzman, E. & Miles, M. (1995). Computer programs for qualitative data analysis. Thousand Oaks, CA: Sage.